IEEE P802.11  
Wireless LANs

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| Restricted TWT Spec Text  Resolving TBDs: Part I | | | | |
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# Abstract

This submission proposes the draft text for restricted TWT TBDs in Draft P802.11be\_D0.4.pdf, to be incorporated into the latest 801.11be draft. The proposed changes also resolve CIDs 2920 of DraftP802.11be\_D0.3.pdf.

The resolution for TBDs and CIDs focuses on the restricted TWT setup procedure.

Revisions:

* Rev 0: Initial version of the document
* Rev 1: Addressed feedback received over rev0, and added/elaborated on three discussion items. The doc has two options to be decided by the group.
* Rev 2: Develop draft following the option #b per SP results (#a / #b / abstain: 12 / 37 /36)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| CID | Clause | Page | Comment | Proposed change | Resolution |
| 2920 | 35.6 | 146.58 | (The part of PDT about quality of service for latency sensitive traffic was approved, and a motion of SP#1 about restricted TWT in 20/1046r11 was passed.) The restricted TWT is based on the broadcast TWT. The clear definition is needed to what kinds of data are transmitted during the restricted SP. In "Broadcast TWT Recommendation" of request type field format in a Broadcast TWT parameter set field, the value from 4 to 7 is reserved. By using one of the reserved values, the traffic can be defined for the restricted SP. | As in comment. | Revised.  Please see discussion section.  This draft text defines rTWT SP as described in subclause 9.4.2.199.  **TGbe editor, please implement changes as shown in latest revision doc 11-21/462 tagged 2920.** |

# Discussion:

1. We compared three options with regards to defining a restricted TWT identifier in the TWT element:
   1. repurpose the Reserved field located at bit-15 of the Request Type field to be the Restricted TWT subfield.
   2. use value 4 of of the Broadcast TWT Recommendation field as the restricted TWT identifier.
   3. use one of the two reserved bits (B6 or B7) of the Control field.

All three options are illustrated in the figure below. Since restricted TWT uses broadcast TWT as the basis for signaling (reuses many fields of Broadcast TWT Parameter Set field), and since a single TWT element may carry both Broadcast and Restricted TWT schedules (explained below in #2 and #3), it is not suitable to use one of the reserved bits in Control field which applies to an entire TWT element and not a particular Broadcast TWT Parameter Set field. Both (a) and (b) can serve the functionality requirement and (a) is preferred and rev1 is developed assuming Option a.

![Graphical user interface, diagram

Description automatically generated]()

Ran SP in the meeting 04/26/2021: Option #b has majority of support. (option a/b/abstain: 12/37/36). Rev 2 is developed assuming option (b) as result.

1. In the TWT element design for restricted TWT purpose, we consider the current baseline where one Broadcast TWT element can include multiple schedules in respective Broadcast TWT Parameter Set fields and intend to support both cases where the receiver is a legacy HE STA or an EHT STA.
2. The design in this proposal keeps the length of the Restricted TWT variant-Broadcast TWT Parameter Set field the same as that of Broadcast TWT Parameter Set field when included in broadcast TWT element for schedule announcements (Negotiation Type = 2). An optional Restricted TWT Traffic Info field is introduced, and is only present in TWT element in unicast frames (Negotiation Type = 3) used for setting up a restricted TWT agreement. As such, for schedule announcements in broadcast frames, we allow a Broadcast TWT element to include both (and possibly multiple) restricted TWT schedules and broadcast TWT schedules, similar to the broadcast TWT baseline behavior.

***Editing instructions formatted like this are intended to be copied into the TGbe Draft (i.e. they are instructions to the 802.11 editor on how to merge the text with the baseline documents).***

***TGbe Editor: Editing instructions preceded by “TGbe Editor” are instructions to the TGbe editor to modify existing material in the TGbe draft. As a result of adopting the changes, the TGbe editor will execute the instructions rather than copy them to the TGbe Draft. Please note the baseline is 11be D0.4.***

# 9. Frame formats

### 9.4.2.199 TWT element

TGbe editor: change Figure 9-687b (Broadcast TWT Parameter Set field format) as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |
|  | Request Type | Target Wake Time | Nominal Minimum TWT Wake Duration | TWT Wake Interval Mantissa | Broadcast TWT Info | Restricted TWT Traffic Info  (optional) |
| Octets: | 2 | 2 | 1 | 2 | 2 | 0 or 5 |
| * Broadcast TWT Parameter Set field format | | | | | | |

***TGbe editor: change the last row of Table 9-299a (Broadcast TWT Recommendation field for a broadcast TWT element) as follows and insert the new paragraph afterwards:***

|  |  |
| --- | --- |
| 4 | The corresponding broadcast TWT SP is referred to as restricted TWT SP.  Frames transmitted during a restricted TWT SP by a TWT scheduling AP or a TWT scheduled STA are required to be limited to latency sensitive traffic and frames supporting its delivery:   * Frame exchanges for delivery of QoS Data frames of TIDs indicated by the Restricted TWT DL/UL TID Bitmap subfield as described in Figure 9-689b (Restricted TWT Info field format), and described in subclause 35.7.2.2 (Latency sensitive traffic differentitation). * QoS Null frames * BQRs (see 26.5.6 (Bandwidth query report operation)(#Ed)) * BSRs (see 26.5.5 (Buffer status report operation)(#Ed)). The TID(s) in the buffer status report have to include the TID(s) indicated by the Restricted TWT DL/UL TID Bitmap subfield as described in Figure 9-689b (Restricted TWT Info field format). * Frames that are sent as part of a sounding feedback exchange (see 35.x (EHT sounding protocol)) * Management frames: Action or Action No Ack frames * Control and control response frames   Trigger frames transmitted by the TWT scheduling AP during the broadcast TWT SP do not contain RUs for random access (see 26.5.3 (UL OFDMA-based random access (UORA))). |
| ~~4-7~~5-7 | Reserved |

A value of 4 in the Broadcast TWT Recommendation field indicates that the TWT schedule specified by the corresponding Broadcast TWT Parameter Set field is a restricted TWT schedule. A Broadcast TWT Parameter Set field that has the Broadcast TWT Recommendation field set to 4 is also referred to as a Restricted TWT Parameter Set field.

A broadcast TWT element that contains only Restricted TWT Parameter Set field(s) is also refered to as a restricted TWT element.

***TGbe editor: (note only) Option 1:***

***TGbe editor: change Figure 9-689a (Broadcast TWT Info subfield format) as follows:***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | ~~B0~~        B2 | B3         B7 | B8                B15 |
|  | Peer-to-Peer | Restricted TWT Traffic Info Present | Reserved | Broadcast TWT ID | Broadcast TWT Persistence |
| Bits: | 1 | 1 | ~~3~~1 | 5 | 8 |
| * Broadcast TWT Info subfield format | | | | | |

***TGbe editor: modify paragraph 2 at Page 191 of P802.11ax D8.0 (Within a TWT element that includes a TWT setup command …) as follows:***

When included in a Restricted TWT Parameter Set field, the first bit (B0) of the Broadcast TWT Info subfield is defined as the Peer-to-Peer subfield.

The Peer-to-Peer subfield, when transmitted by a restricted TWT scheduling AP, is set to 1 to indicate that the AP allows the restricted TWT scheduled STA to transmit or receive latency sensitive traffic for its peer-to-peer link(s) during the restricted TWT SPs of this schedule; and set to 0 otherwise.

The Peer-to-Peer subfield, when transmitted by a restricted TWT scheduled STA, is set to 1 to indicate that the STA intends to transmit or receive latency sensitive traffic over its peer-to-peer link(s) as part of latency sensitive traffic to be delivered in the corresponding restricted TWT SPs; and set to 0 otherwise.

When included in a Restricted TWT Parameter Set field, the second bit (B1) of the Broadcast TWT Info subfield is defined as the Restricted TWT Traffic Info Present subfield, and is set to 1 to indicate that the Restricted TWT Traffic Info field is present; and set to 0 otherwise.

Within a TWT element that includes a TWT setup command value of Request TWT, Suggest TWT or Demand TWT, the Broadcast TWT ID, if present, indicates a specific Broadcast TWT in which the transmitting STA is requesting to participate. Within a TWT element that includes a TWT setup command value of Accept TWT, Alternate TWT, Dictate TWT or Reject TWT, the Broadcast TWT ID, if present, indicates a specific Broadcast TWT for which the transmitting STA is providing TWT parameters. Within a TWT element that includes a TWT setup command value of TWT Grouping, the Broadcast subfield is 0 and the Broadcast TWT ID, is not present. The value 0 in the Broadcast TWT ID subfield indicates the broadcast TWT whose membership corresponds to all STAs that are members of the BSS corresponding to the BSSID of the Management frame carrying the TWT element and that is permitted to contain Trigger frames with RA-RUs for unassociated STAs. The Broadcast TWT ID subfield in a Restricted TWT Parameter Set field shall be set to a non-zero value.

***TGbe editor: insert the following paragraph and Figure after paragraph (The Broadcast TWT Persistence subfield indicates …):***

The Restricted TWT Traffic Info field is present in a Restricted TWT Parameter Set field when the Restricted TWT Traffic Info Present subfield of the Request Type field is set to 1. Its format is defined in Figure 9-689b (Restricted TWT Traffic Info field format).

***TGbe editor: (note only) Option 1 ends.***

***TGbe editor: (note only) Option 2:***

***TGbe editor: insert a new Figure 9-689b ((Restricted TWT variant) Broadcast TWT Info subfield format) after Figure 9-689a (Broadcast TWT Info subfield format) as follows:***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | B0 | B1 | B2 | B3         B7 | B8                B15 |
|  | Peer-to-Peer | Restricted TWT Traffic Info Present | Reserved | Broadcast TWT ID | Broadcast TWT Persistence |
| Bits: | 1 | 1 | 1 | 5 | 8 |
| Figure 9-689b (Restricted TWT variant) Broadcast TWT Info subfield format | | | | | |

***TGbe editor: modify paragraph 2 at Page 191 of P802.11ax D8.0 (Within a TWT element that includes a TWT setup command …) as follows:***

A Restricted TWT Parameter Set field transmitted by a restricted TWT scheduling AP or a restricted TWT scheduled STA shall carry the (Restricted TWT variant) Broadcast TWT Info subfield, as defined in Figure 9-689b ((Restricted TWT variant) Broadcast TWT Info subfield format).

The Peer-to-Peer subfield of the (Restricted TWT variant) Broadcast TWT Info subfield, when transmitted by a restricted TWT scheduling AP, is set to 1 to indicate that the AP allows the restricted TWT scheduled STA to transmit or receive latency sensitive traffic for its peer-to-peer link(s) during the restricted TWT SPs of this schedule; and set to 0 otherwise.

The Peer-to-Peer subfield of the (Restricted TWT variant) Broadcast TWT Info subfield, when transmitted by a restricted TWT scheduled STA, is set to 1 to indicate that the STA intends to transmit or receive latency sensitive traffic over its peer-to-peer link(s) as part of latency sensitive traffic to be delivered in the corresponding restricted TWT SPs; and set to 0 otherwise.

The Restricted TWT Traffic Info Present subfield of the (Restricted TWT variant) Broadcast TWT Info subfield, is set to 1 to indicate that the Restricted TWT Traffic Info field is present; and set to 0 otherwise.

Within a TWT element that includes a TWT setup command value of Request TWT, Suggest TWT or Demand TWT, the Broadcast TWT ID, if present, indicates a specific Broadcast TWT in which the transmitting STA is requesting to participate. Within a TWT element that includes a TWT setup command value of Accept TWT, Alternate TWT, Dictate TWT or Reject TWT, the Broadcast TWT ID, if present, indicates a specific Broadcast TWT for which the transmitting STA is providing TWT parameters. Within a TWT element that includes a TWT setup command value of TWT Grouping, the Broadcast subfield is 0 and the Broadcast TWT ID, is not present. The value 0 in the Broadcast TWT ID subfield indicates the broadcast TWT whose membership corresponds to all STAs that are members of the BSS corresponding to the BSSID of the Management frame carrying the TWT element and that is permitted to contain Trigger frames with RA-RUs for unassociated STAs. The Broadcast TWT ID subfield in a (Restricted TWT variant) Broadcast TWT Info subfield shall be set to a non-zero value.

***TGbe editor: insert the following paragraphs and Figures after paragraph (The Broadcast TWT Persistence subfield indicates …):***

The Restricted TWT Traffic Info field is present in a Restricted TWT Parameter Set field when the Restricted TWT Traffic Info Present subfield of the (Restricted TWT variant) Broadcast TWT Info subfield is set to 1. Its format is defined in Figure 9-689c (Restricted TWT Traffic Info field format).

**TGbe editor: (note only) Option 2 ends.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Traffic Info Control | | Restricted TWT DL TID Bitmap | Restricted TWT UL TID Bitmap |
| Octets: | 1 | 2 | | 2 |
| Figure 9-689b Restricted TWT Traffic Info field format | | | | |

**TGbe editor: (note only) Change title of above figure from Figure 9-689b to 9-689c if Option 2 is selected.**

The Traffic Info Control field is defined in Figure 9-689c (Traffic Info Control field format).

**TGbe editor: (note only) Change above paragraph to “The Traffic Info Control field is defined in Figure 9-689d (Traffic Info Control field format)” if Option 2 is selected.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | B0 | B1 | B2        B7 |
|  | DL TID Bitmap Valid | UL TID Bitmap Valid | Reserved |
| Bits: | 1 | 1 | 6 |
| Figure 9-689c Traffic Info Control field format | | | |

**TGbe editor: (note only) Change title of above figure from Figure 9-689c to 9-689d if Option 2 is selected.**

The DL TID Bitmap Valid subfield indicates if the Restricted TWT DL TID Bitmap field has valid information. When the value is set to 0, the Restricted TWT DL TID Bitmap field is reserved.

The UL TID Bitmap Valid subfield indicates if the Restricted TWT UL TID Bitmap field has valid information. When the value is set to 0, the Restricted TWT UL TID Bitmap field is reserved.

The Restricted TWT DL/UL TID Bitmap subfields specify which TID(s) are identified by the TWT scheduling AP or the TWT scheduled STA as latency sensitive traffic streams in the downlink and uplink direction, respectively. A value of 1 (0) at bit position *k* in the bitmap indicates that TID *k* is (is not) classified as latency sensitive traffic stream.

# 35.7 Restricted TWT

## 35.7.2 Restricted TWT agreement setup

### 35.7.2.1 General

***TGbe editor: replace TBD with the following paragraphs:***

A restricted TWT agreement is established using the same procedure used to set up a broadcast TWT agreement as described in 26.8.3 (Broadcast TWT operation) except that the TWT setup frames contain a broadcast TWT element that includes a Restricted TWT Parameter Set field as described in 9.4.2.199 (TWT element).

A restricted TWT scheduling AP is an EHT AP that supports restricted TWT operation. It may set the Broadcast TWT Support field in the HE Capabilities element it transmits to 0 or 1. If the restricted TWT scheduling AP sets the Broadcast TWT Support field in the HE Capabilities element it transmits to 0, then the broadcast TWT element(s) it includes in any applicable management frames have to be restricted TWT element(s) as described in 9.4.2.199 (TWT element); otherwise, the restricted TWT scheduling AP is also a TWT scheduling AP, and there is no such restriction on the type of broadcast TWT elements it may include.

A restricted TWT scheduled STA is a non-AP EHT STA that supports restricted TWT operation. It may set the Broadcast TWT Support field in the HE Capabilities element it transmits to 0 or 1. If the restricted TWT scheduled STA sets the Broadcast TWT Support field in the HE Capabilities element it transmits to 0, then it only supports a broadcast TWT setup procedure during which any TWT element it transmits is also a restricted TWT element; otherwise, the restricted TWT scheduled STA is also a TWT scheduled STA, and does not have the aforementioned restriction.

A restricted TWT scheduling AP or restricted TWT scheduled STA which transmits a restricted TWT element with Negotiation Type subfield set to 3 shall set the Restircted TWT Traffic Info Present subfield of the Broadcast TWT Info field to 1, and include Restricted TWT Traffic Info field in the Restricted TWT Parameter set field. If the Negotiation Type subfield of a broadcast TWT element is set to 2, the Restricted TWT Parameter Set field, if included, shall set the Restricted TWT Traffic Info Present subfield to 0, and shall not include the Restricted TWT Traffic Info field accordingly.

**Straw Poll: Do you support to incorporate the proposed draft text in this document 11-21/462r2, to the latest TGbe Draft?**

**Result: Yes/No/Abstain**